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GB 2302290 A
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(54) Abstract Title
A water purification system

(57) A water purification method and system 1 comprises a first chamber 3 for receiving water to be purified, a screen filter 20 through which water is drawn from the first chamber 3 and which supplies filtered water to a biological filtration system 8a, 8b contained in at least one separate chamber, a return passage 31 which returns water to a pond (30, Fig 3) and pump means (35, Fig 3) to generate water circulation within the system 1. Part of the first chamber 3 is a sump 15 for collecting particulate material and the screen filter 20 is provided with a backwash device 25 which dislodges particulates from the screen 20 by means of a reverse fluid flow through the screen. The water purification system may be used as part of a gravity flow or pumped filtration system. Advantageously the water of ponds, aquaria and other water features remains free of dissolved impurities and suspended particulate matter.

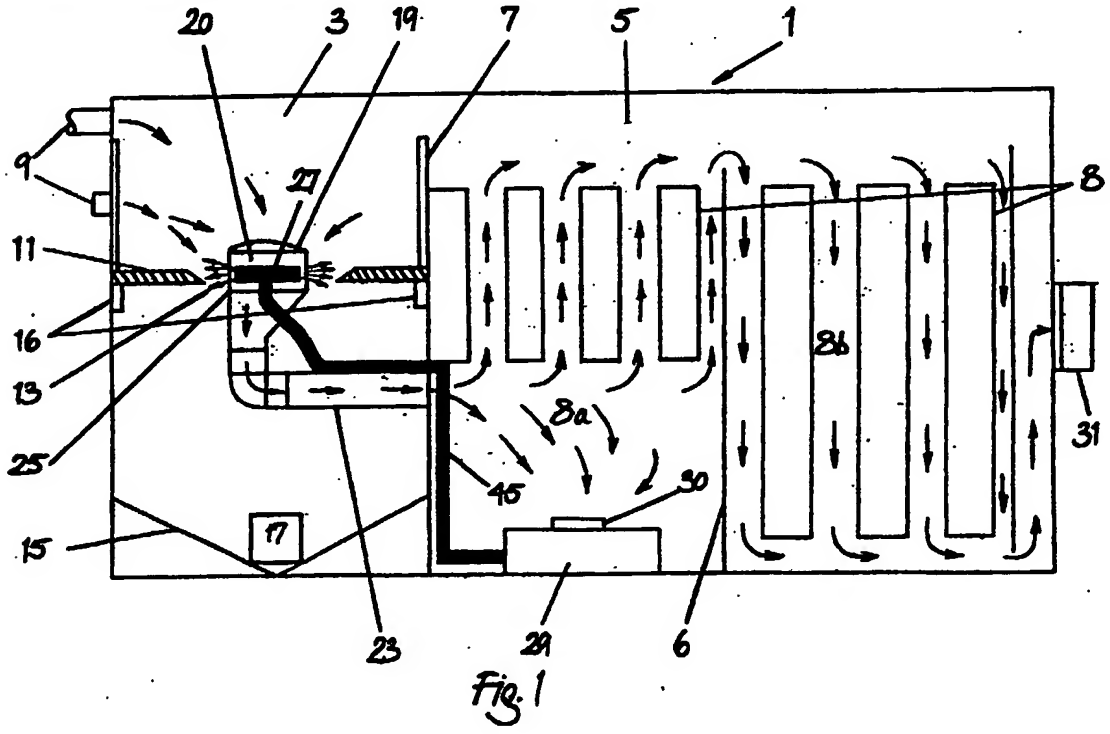

Fig. 1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date but within the period prescribed by Rule 25(1) of the Patents Rules 1995.

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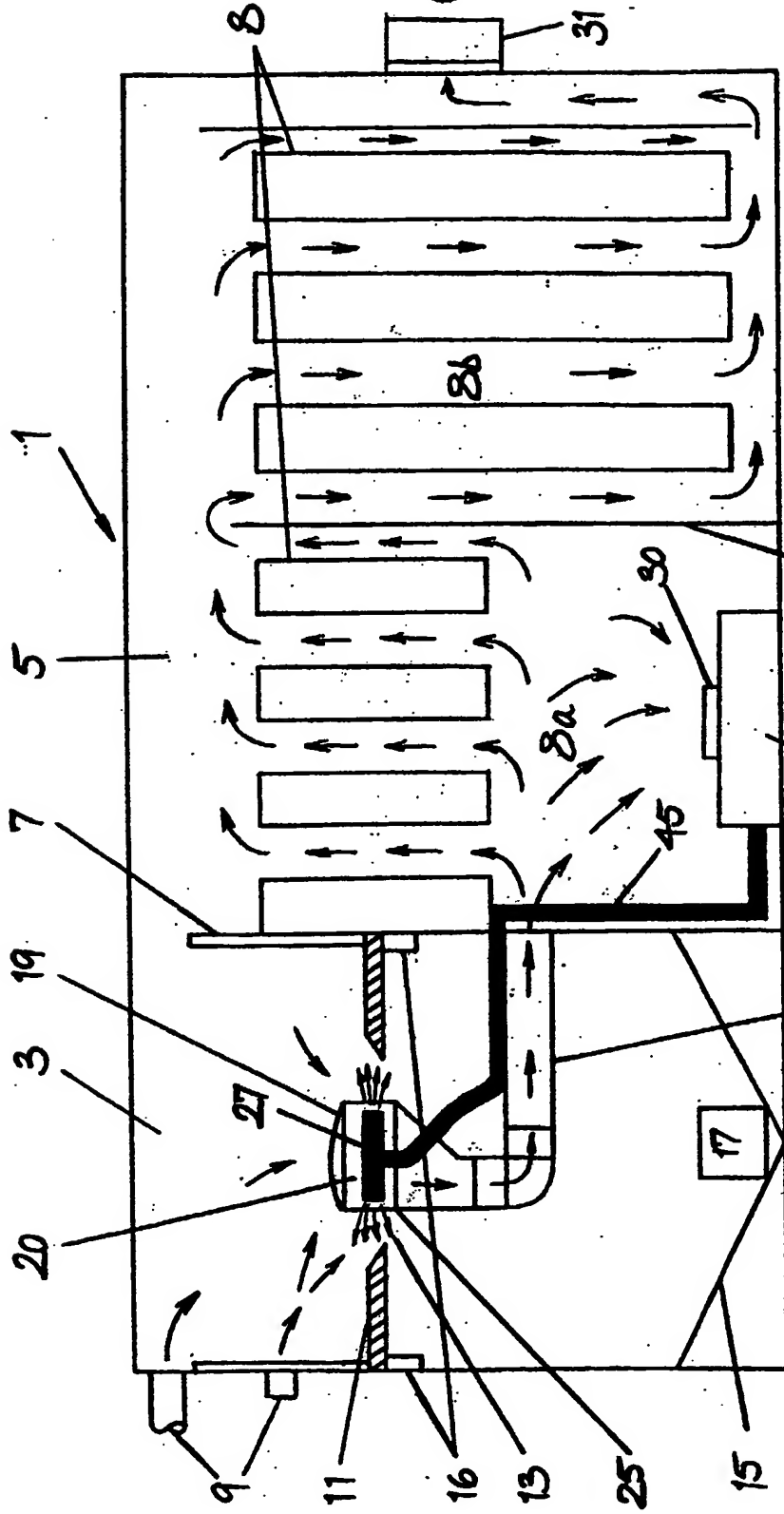

Fig. 1

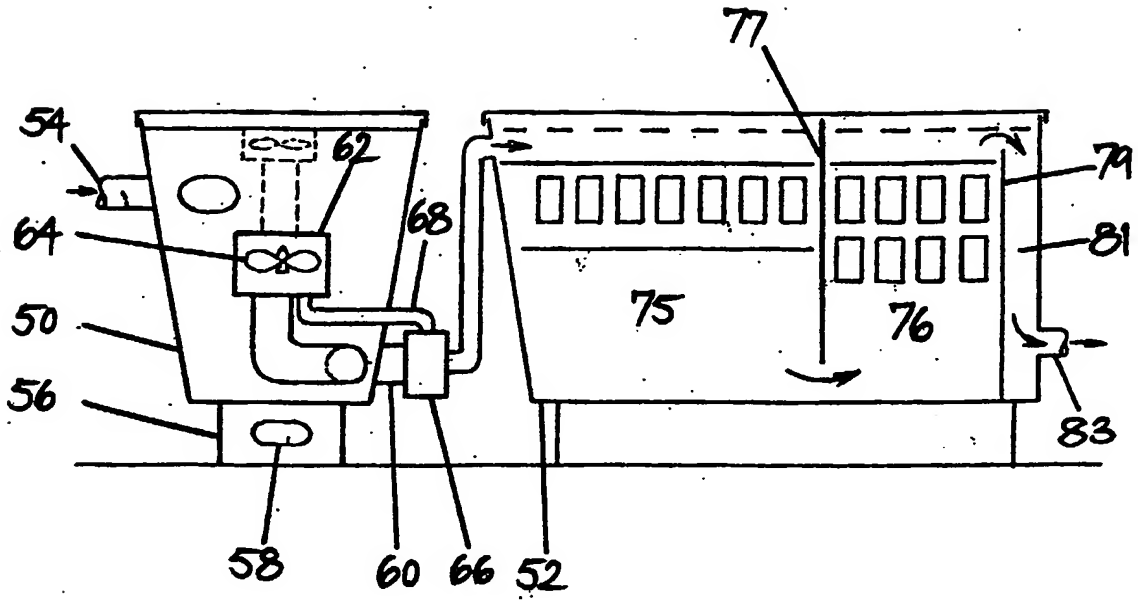

Fig. 2

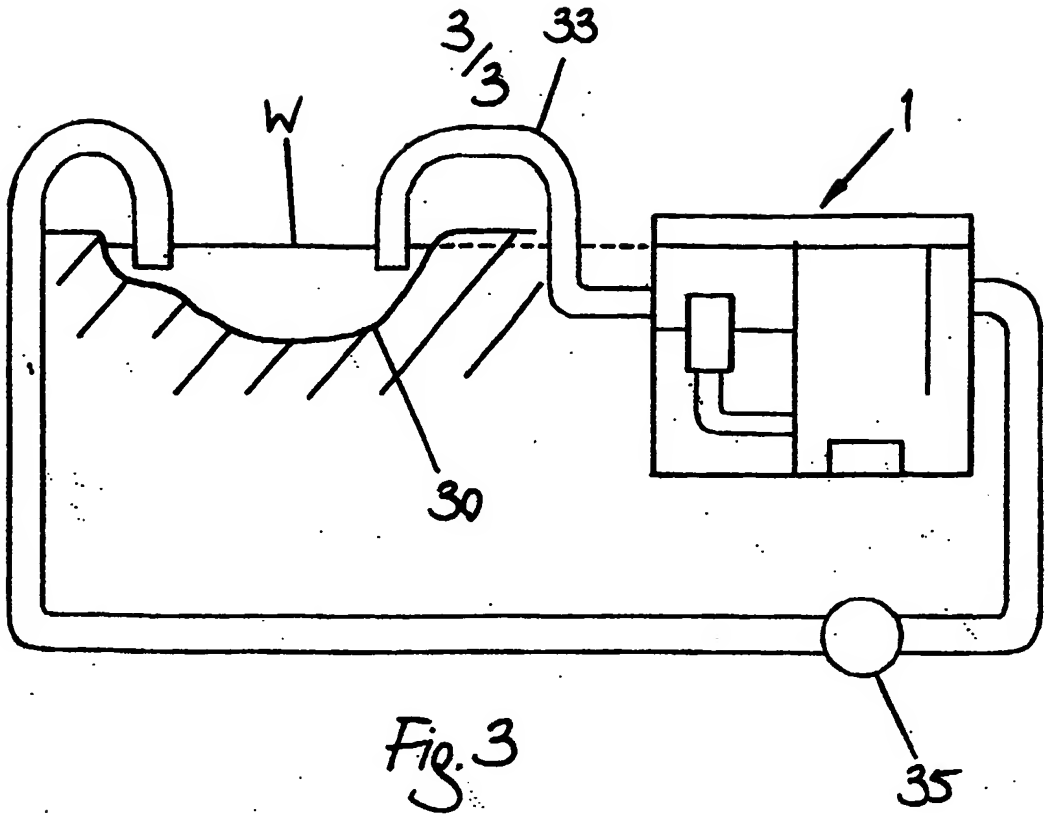

Fig. 3

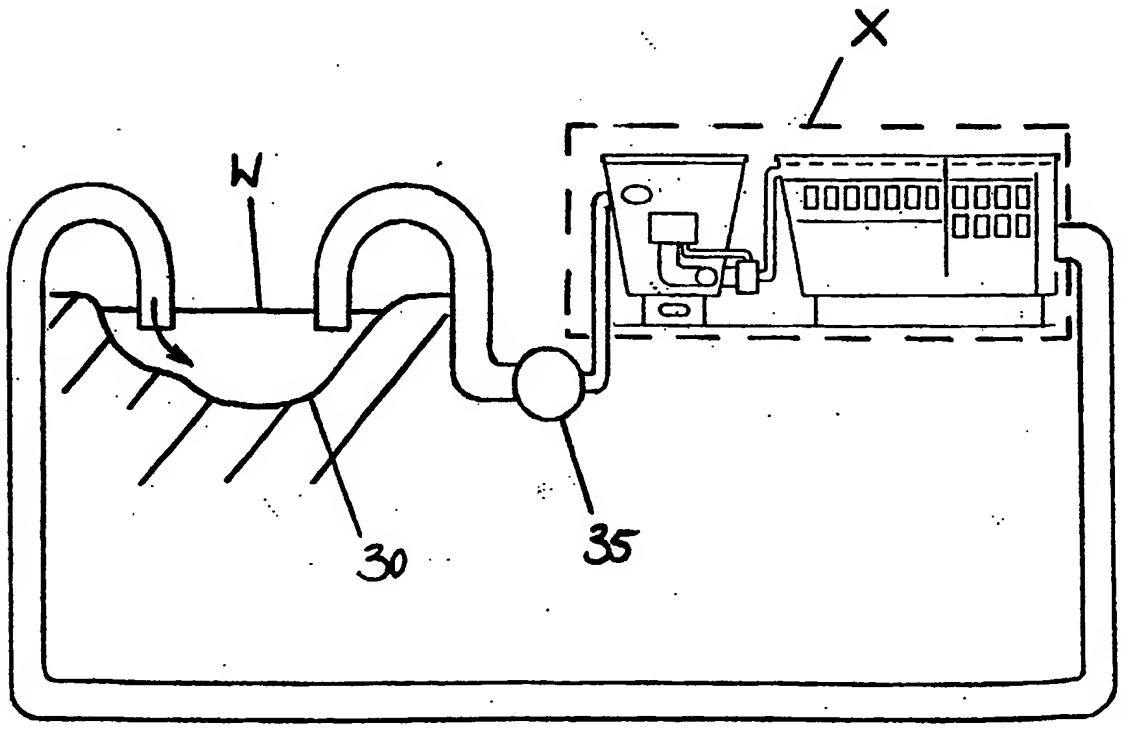

Fig. 4

Title: Water Purification System

DESCRIPTION

The present invention relates to a method and apparatus for purifying the water of aquaria, ponds containing fish, swimming pools or water features.

One of the problems with keeping ornamental fish is ensuring that the water remains clear, being both free of dissolved impurities and suspended particulate material. The more expensive the fish the more sophisticated the filtration techniques which are used, and for keepers of Koi Carp it is usual to remove dissolved contaminants by passing the pond water through a bio-mass filter medium. The larger the pond, in relation to the stocking density and hence the amount of pollution created, the more extensive these bio-mass filtration systems have to be. However, the bio-mass medium can become contaminated with particulate material if this is not removed and there are two basic systems for attempting to remove particulate material before it reaches the bio-mass. In the most basic solution a submersible pump is disposed in the pond and the inlet to the pump carries a mesh filter so that particulate material greater than the size of the holes in the mesh is removed before being passed to the bio-mass filter. However, this has two disadvantages. Firstly particulate material remains in the pond and secondly the mesh inevitably becomes clogged. In an alternative solution, water extracted from the pond without filtration is passed to a filter which uses a vortex/cyclone system to separate out particulate material before

passing the water to the bio-mass filter. Whilst this removes a considerable amount of particulate material it does not prevent some of the lighter particles passing into the bio-mass and remaining there. This has been tolerated by using larger sizes for the bio-mass so that the interstitial spaces between the bio-mass do not readily become clogged by the small particulate material which pass it into the bio-mass. This necessitates the use of considerably greater volume of bio-mass than would be necessary if smaller bio-mass particles could be used. Other systems that have been tried for pre-filtering the water prior to passage to the bio-mass utilise tanks containing brushes, sponges, cotton wool, nylon stockings/tights and/or combinations thereof. However, these also become clogged with particulated material and have to be removed for cleaning and/or replaced at frequent intervals.

The present invention aims to provide a solution to the above problems.

Accordingly, one aspect of the invention provides a method of purifying the water of a pond or aquaria or other water feature on a recirculatory basis, the method comprising the steps of extracting water from the pond and delivering it to a catchment tank separate from the pond, extracting water from the catchment tank via a screen filter and feeding the filtered water to further biological filtering/cleaning means; returning the finally filtered water to the pond, the method further comprising using a back pressure device to dislodge particulate material from the inlet side of said screen and allowing said particulate material to accumulate in a sump of the catchment tank for periodic removal.

Preferably the back pressure device utilises a fluid to dislodge the particulate material from the screen. In one embodiment some of the filtered water extracted downstream of the screen filter is used as the fluid to dislodge the particulate material. In another embodiment the fluid is provided from a separate source that is devoid of particulate material. The fluid could be water but equally could be gas which would not increase the volume of liquid in the system. Preferably air is used or one of its constituents, for example, oxygen.

The method has the advantage that the particulate material collects in a tank which is separate from the pond. Furthermore, the screen can have a very small sized mesh, enabling even the smallest particles to be removed. In order to encourage the particulate material which is dislodged from the screen to settle in the sump, it is preferred to partition the catchment tank in such a way that there is a pressure gradient across the mesh which has the effect of moving the dislodged particulate material in a direction towards the sump. This can be achieved by arranging for the screen to form at least part of the periphery of a housing and to have the periphery disposed within an orifice of the partition, which orifice influences the flow of liquid past the screen. A venturi effect may be relied upon to reduce the pressure downstream of the orifice thereby causing the particulate matter to migrate in the direction of the reduced pressure. Usually the orifice will be horizontal to gain maximum benefit. Water extracted from the pond is delivered into the catchment tank to one side of the partition whilst particulate material accumulates on the other side of the partition. Water may be extracted from the pond and delivered to the catchment tank using a pump.

Alternatively, the flow of liquid from the pond to the catchment tank may be achieved by relying on gravity, and the filtered water is pumped back into the pond to create the necessary circulation. A differential head may be created between the catchment tank and the subsequent biological filtering sections to generate the flow. The partition may be formed by the base of a tray like structure which is received in the top of the catchment tank.

One embodiment of apparatus for performing the method comprises a first chamber receiving unfiltered water from the pond, a screen filter through which water is drawn in from the first chamber and which supplies filtered water to a biological filtration system contained in one or more separate chambers, a return passage by which water is returned to the pond, and pump means to generate a circulation in the system, and wherein the first chamber comprises a sump for collection of particulate material, and wherein the screen filter is provided with a back pressure device which acts to dislodge particulate material from the screen by means of a reverse fluid flow through the screen.

Preferably, the fluid is filtered water, and preferably a pump is provided to supply the filtered water to the back pressure washing means. Preferably the pump is disposed in the one or more separate chambers containing the bio-mass to take mechanically filtered/strained water into its inlet. Preferably the back washing means comprises a jet mounted to rotate with respect of the screen filter. The first chamber may be a separate entity whose output is passed to a separate biological filtration system or the first chamber may be part of apparatus incorporating the biological filtration means.

In another embodiment the first chamber comprises a vortex/cyclone separator into which the unfiltered pond water is introduced and the outlet from the vortex/cyclone separator is provided with a screen filter having a back washing device. The filtered water passes to separate biological filtering means.

Another aspect of the invention provides apparatus for use in a method of purifying water of aquaria, ponds containing fish, swimming pools or water features on a recirculating basis, the apparatus comprises a pre-filter comprising a catchment tank into which water to be filtered is introduced, and accommodating a screen filter via which water is extract from the catchment tank to be returned to its source via any other filtration means, and wherein the screen filter is provided with a back pressure device to dislodge partculate material from the screen, and wherein the catchment tank has a sump in which dislodged particulate material accumulates for periodic removal.

The catchment tank may have any of the features of said one embodiment described above when embodied as a separate piece of apparatus, for use as an additional item in the filtration of aquaria, ponds, swimming pools and/or water features. More preferably the tank has a tray having an orifice in the base in which a housing provided with the screen filter is disposed, and in which the tray serves to partition the catchment tank defining a water inlet section and a sump for the particulate material. The back washing device can take any of the forms discussed herein.

Such an apparatus can be used as a pre-filter before a vortex type filter.

The present invention will now be described by way of example only with

The present invention will now be described by way of example only with reference to the accompanying drawings in which:-

Figure 1 shows a diagrammatic side view of the first embodiment of the apparatus for use in performing the method of the invention,

Figure 2 shows an alternative embodiment apparatus for carrying out the method,

Figure 3 illustrates the apparatus of Figure 1 in a so called gravity flow filtration system,

Figure 4 illustrates the apparatus for Figure 2 in a pumped filtration system,

Firstly, referring to Figure 1, there is illustrated a generally rectangular tank 1 having a base and four sidewalls and an open top which is preferably provided with a cover 2. The tank is divided into first and second sections 3, 5, by a wall 7. The particulate material is removed in the first section and the second section contains bio-mass 8 for biologically purifying the water. The bio-mass section 8 is itself divided into two sections 8a, 8b, by a partition wall 6. The first section comprises a chamber which receives water to be filtered via an inlet port 9. The chamber is divided intermediate its upper and lower extremities by a partition wall 11 which has an orifice 13. The lower part of the chamber has a tapered configuration defining a sump 15 at the bottom thereof for the collection of particulate material. A valved outlet 17 can be opened to facilitate the removal of particulate material. The partition wall is formed by the base of a four sided tray 14 having a continuous periphery. The tray is preferably

removable. The tray fits into the upper end of the first section and is supported on a ledge 16. The top edge of the tray allows the water level in the first section to be higher than that in the second section.

A filter housing 19 is disposed in the first chamber and it has a peripheral wall which is provided with a screen filter 20 through which water from the chamber is drawn into the housing and passes along a passageway 23 which opens into the second section 5. The housing is positioned in the orifice in the partition. The purposes of this will be described further herein.

Also illustrated is a back flow device 25 which comprises a rotor element 27 mounted for rotation within the housing and whose opposite ends have openings through which water is forced under the action of a pump 29. The pump 29 draws its water supply from the downstream side of the filter means by way of inlet 30.

The second section 8b has an outlet port 31 for filtered and purified water. It may be provided with a slide valve to control the flow rate and the water level in the two bio-mass compartments 8a, 8b .

Figure 3 illustrates the apparatus of Figure 1 in conjunction with a pond 30 whose water is to be filtered and purified. In the illustration the tank 1 is connected to the pond 30 by way of a pipeline 33 and is positioned such that the level of water in the tank will be determined by the level of water W in the pond. A pump 35 generates the circulation in the system by pumping finally filtered water from the outlet of the tank 1 back to the pond. In operation water to be filtered enters the first section of the tank 1 and the operation of the pump 35

causes water to be drawn through the screen filter of housing 19. If it were not for the back flow device 25 this would result in particulate material lodging on the outside of the screen and prohibiting the flow of water into the bio-filter section. However, the back flow device counteracts this in that pump 29 draws a small proportion of filtered water from the second section 5 and passes it along the passageway 45 under pressure to the rotor element 27. The flow of water from the openings at the ends of the rotor causes the rotor to rotate and some of the water passes through the screen filter causing any particulate material to be dislodged. The amount of water flowing through the back flow device is less than the total amount of water being drawn in by the filter element. The water below the partition is relatively calm whereas the water above is moving. In addition the positioning of the housing within the orifice is such that the water being drawn in generates a pressure drop between one side of the partition and the other. These factors have the effect of causing the particulate material which is dislodged from the screen to sink and, in due course, will settle in the sump 15. The removal of particulate material in this manner has the advantage that particulate material is removed from the pond and yet does not enter the bio-mass and thereby enables a bio-mass to be used which has a smaller particulate size and as a consequence a lesser volume of material can be used to achieve the same purifying effect. The rating of the pumps 35 and 29 will depend on the particular application. In one example, the pump 35 was rated at 1500 gals per hour, whilst the pump 29 was only rated at 300 gals per hour. In some systems the pump 29 can be omitted. For example, a small proportion of

the filtered water being pumped by pump 35 in the embodiment of Figure 3 can be diverted to power the back pressure washing device.

Reference is now made to Figure 2, which describes an alternative embodiment of filtration apparatus. In this embodiment, removal of particulate material is carried out in a catchment tank 50 which comprises a modified vortex/cyclone separator. The biological filter medium is contained in a separate tank 52.

The vortex separator has an inlet 54 in a sidewall thereof. The separator is circular in horizontal section and water is introduced in a manner to set up a swirling motion. The filter separates out large particulate material in a manner which is well known and not described further herein. The particulate matter collects in a sump 56 at the base of the chamber and can be removed by way of a valved outlet 58.

Water is withdrawn from the chamber via an outlet pipe 60 which draws water from the centre of the tank. The inlet to the outlet pipe is provided with a housing 62 having a screen filter. The housing accommodates a back pressure washing device for clearing particulate material from the screen by means of a reverse fluid flow. The back washing device comprises a rotor 64, the rotation of which generates a localised flow of fluid through the screen in a direction opposite to the direction that water is being withdrawn from the catchment tank.

In the illustrated embodiment the rotor 64 is supplied with water under pressure from the filtered side of the screen filter. The rotor is hollow and has openings at the ends of the rotor blades through which water emerges. A pump

or flow director 66 extracts some of the filtered water and passes it along pipeline 68 to the rotor. As the rotor rotates particulate material is displaced from the screen and will sink down into the sump 56. The vertical position of the filter housing 62 does not have to be limited to the position shown. It may be closer to the top or lower down.

Water is pumped into the inlet 54 of the vortex separator to generate the necessary flow velocity and returned to the pond under gravity having passed through the vortex separator 50 and the biological filter 52. The latter can be of any convenient configuration and is illustrated in Figure 2 as comprising two sections 175, 176 separated by a partition 77 and leading over a weir 79 to an outlet chamber 81 having an outlet 83. The outlet chamber may incorporate aeration means. A tray 11 in Figure 1 or similar separator or partition may be incorporated.

Figure 4 illustrates how either of the apparatus of Figure 1 or 2, represented by filter section X shown in dotted outline, could be used in a pumped circulatory system, i.e., where there is no relation between the level of water in the pond and the level of water in the filtration unit.

In the illustrated embodiments, the back pressure device is supplied with water by a pump. This can be omitted as previously discussed. Alternative embodiments are envisaged in which the flow of water from the pond is used to generate rotation of a back pressure device – say by means of an impeller connected to the rotor to rotate same, and in which the rotor relies on the generation of a pressure wave to dislodge the particulate material from the

mesh. The pressure wave in effect creates a back pressure and so operates as a back pressure device. Other means of driving the rotor of the back pressure device may be used.

Whilst the present invention has been described by way of example in connection with one particular application to filtering water for aquaria or ponds containing fish, it has applications as a pre-filter for other applications as mentioned above. Thus, it will be apparent from the foregoing that the catchment tank comprising the first section of the apparatus described in Figure 1 can be configured as a stand alone tank for use as a pre-filter.

CLAIMS

1. A method of purifying the water of a pond or aquaria or other water feature on a recirculatory basis, the method comprising the steps of extracting water from the pond and delivering it to a catchment tank separate from the pond, extracting water from the catchment tank via a screen filter and feeding the filtered water to further biological filtering/cleaning means; returning the finally filtered water to the pond, the method further comprising using a back pressure device to dislodge particulate material from the inlet side of said screen and allowing said particulate material to accumulate in a sump of the catchment tank for periodic removal.

2. A method as claimed in claim 1 in which the back pressure device utilises fluid to dislodge the particulate material from the screen.

3. A method as claimed in claim 2 in which filtered water extracted downstream of the screen filter is used as the fluid to dislodge the particulate material.

4 A method as claimed in claim 2 or 3 in which a pump is used to extract the fluid and pass it back through the screen filter.

5. A method as claimed in claim 2 in which said fluid is provided from a source that is devoid of particulate material and is not derived from the water to be purified.

6. A method as claimed in claim 5 in which the fluid is a gas.

7. A method as claimed in claim 5 or 6 in which the fluid is air.

8. A method as claimed in any one of the preceding claims in which water extracted for purification is delivered into the catchment tank at an upper location and particulate material is allowed to accumulate at a lower location.

9. A method as claimed in any one of the preceding claims in which a pump is used to generate water circulation.

10. A method as claimed in any one of the preceding claims in which a differential head is created between the catchment tank and the subsequent biological filtering sections to generate the flow.

11. A method is claimed in any one of the preceding claims in which particulate material is removed from the sump by opening a drain valve.

12. A method of purifying water substantially as hereinbefore described with reference to and as illustrated in any of the accompanying drawings.

13. Apparatus for performing the method comprising a first chamber receiving unfiltered water to be purified, a screen filter through which water is drawn in from the first chamber and which supplies filtered water to a biological filtration system contained in one or more separate chambers, a return passage by which water is returned to the pond, and pump means to generate a circulation in the system, and wherein the first chamber comprises a sump for collection of particulate material, and wherein the screen filter is provided with a back pressure device which acts to dislodge particulate material from the screen by means of a reverse fluid flow through the screen.

14. Apparatus as claimed in claim 13 further comprising a pump to supply filtered water to the back pressure washing means.

15. Apparatus as claimed in claim 14 in which the pump is disposed in the one or more separate chambers containing the biological filtration means to take mechanically filtered/strained water into its inlet.

16. Apparatus as claimed in any one of claims 13, 14 or 15 in which the back

pressure washing means comprises a jet mounted to rotate with respect of the screen filter.

17. Apparatus as claimed in any one of claims 13 to 16 in which the first chamber is a separate entity whose output is passed to a separate biological filtration system.

18 Apparatus as claimed in any one of claims 13 to 16 in which the first chamber is part of apparatus incorporating the biological filtration means.

19 Apparatus as claimed in any one of claims 13 to 18 in which the screen filter is mounted to a tray that is received removably in said first compartment and in which the particulate material accumulates below the tray.

20 Apparatus as claimed in any one of claims 12 to 15 in which the first chamber comprises a vortex/cyclone separator into which the unfiltered water to be purified is introduced and the outlet from the vortex/cyclone separator is provided with a screen filter having a back washing device.

21 Apparatus for use in a method of purifying water of aquaria, ponds containing fish, swimming pools or water features on a recirculating basis, the apparatus comprising a pre-filter comprising a catchment tank into

which water to be filtered is introduced, and accommodating a screen filter via which water is extracted from the catchment tank to be returned to its source via any other filtration means, and wherein the screen filter is provided with a back pressure device to dislodge particulate material from the screen, and wherein the catchment tank has a sump in which dislodged particulate material accumulates for periodic removal.

22 Apparatus as claimed in claim 21 in which the catchment tank has a removable tray to which the screen filter with back washing device is mounted and in which the tray serves to partition the catchment tank to define a water inlet section above a base of the tray and a sump for the particulate material underneath the tray.

23 Apparatus as claimed in claim 22 in which sides of the tray extend above the water level in the catchment tank.

24 Apparatus as claimed in any one of claims 13 to 23 in which the sump has a valved outlet for removal of the particulate material.

25 Apparatus for use in purifying water on a recirculating basis constructed and arranged substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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INVESTOR IN PEOPLE

Application No: GB 0101489.3
Claims searched: 1 - 25

Examiner: Beverley Lloyd
Date of search: 21 August 2001

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): B1D (DNCK, DNRA, DPLC)

Int Cl (Ed.7): A01K 63/04; B01D 29/00

Other: Online: WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	GB 2302290 A	(FIRMIN) See Fig 1, sump item 3	
X	GB 1341138 A	(INDUSTRIAL) See Fig 1, page 4, lines 7 - 19	1 - 6, 8, 9, 11, 13, 14, 21, 24
X	DE 20000897U	(BIERDUEMPEL) See Fig 1 and abstract	1, 13 & 21 at least
A	US 4312752 A	(MALIK) See Fig 5 & abstract	
X	US 4025431 A	(SAXTON) See Figs1 & 3, dirt collection enclosure 14, col 2, lines 59 - 65, col 3, lines 1 - 8, col 4, lines 16 - 22, col 5, lines 51 - 55	1 - 4, 8 - 9, 13, 14, 21

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.